# 9.0 Quality Assurance of Surveillance and Monitoring Programs

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Quality assurance and quality control practices encompassed all aspects of Hanford Site environmental monitoring and surveillance programs. This section provides descriptions of specific measures for maintaining quality in project management, sample collection, and analytical results.

Samples were collected and analyzed according to documented standard analytical procedures. Analytical data quality was verified by a continuing program of internal laboratory quality control, participation in interlaboratory crosschecks, replicate sampling and analysis, submittal of blind standard samples and blanks, and splitting samples with other laboratories.

Quality assurance/quality control for the Hanford Site environmental monitoring and surveillance programs also include procedures and protocols to:

- Document instrument calibrations.
- Conduct program-specific activities in the field.
- Maintain groundwater wells to collect representative samples.
- Avoid cross-contamination by using dedicated well sampling pumps.

## 9.0.1 Environmental Surveillance and Groundwater Monitoring

During 2002, comprehensive quality assurance programs, including various quality control practices, were maintained to assure the quality of data collected through the Surface Environmental Surveillance Project and the Hanford Groundwater Monitoring Project. Quality assurance plans were maintained for all program activities and defined the appropriate controls and documentation required by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) for the project-specific requirements.

### 9.0.1.1 Project Management Quality Assurance

Site environmental surveillance, groundwater monitoring, and related programs such as processing of thermoluminescent dosimeters and performing dose calculations were subject to an overall quality assurance program. This program implemented the requirements of DOE Order 414.1A. Quality assurance plans are maintained by the site surveillance and groundwater monitoring projects; these plans describe the specific quality assurance elements that apply to each project. These plans were approved by a quality assurance organization that conducted surveillances and audits to verify compliance with the plans. Work performed through contracts, such as sample analysis, must meet the same quality assurance requirements. Potential equipment and service suppliers are audited before service contracts or material purchases that could have had a significant impact on quality within the project are approved and awarded.

### 9.0.1.2 Sample Collection Quality Assurance/ Quality Control

Surface Environmental Surveillance Project samples were collected by staff trained to conduct sampling according to

approved and documented procedures (PNL-MA-580). Continuity of all sampling location identities was maintained through careful documentation. Field replicates were collected for water and biota samples (Table 9.0.1). One hundred percent of the field replicate results with the result greater than the minimum detectable activity for 2002 were acceptable. The results were acceptable if the relative percent difference was <±30% for the sample and duplicate, as specified in the analytical services contract.

**Relative percent difference (RPD)** – A measure of the precision of the measurement of a sample (S) and its duplicate (D). The formula is

$$RPD = 100 * |S-D| / ((STD)/2)$$

Samples for the Hanford Groundwater Monitoring Project were collected by trained staff according to approved and documented procedures (PNNL-14187, Appendix B). Chain-of-custody procedures were followed (EPA 1986). Samples representing full trip blanks and field duplicates were obtained during field operations. Summaries of the 2002 groundwater field quality control sample results are provided in Appendix B of PNNL-14187. The percentage of acceptable field blank and duplicate results during fiscal year 2002 was 96% for field blanks and 97% for field duplicates. For field blanks, a result was acceptable if it was less than two times the method detection limit for non-radiological data, or less than two times the total propagated analytical uncertainty. This indicates that there was not a contamination problem found with the sample. For field duplicates, the result was acceptable if the measured precision was within 20%, as measured by the relative percent difference.

## 9.0.1.3 Analytical Results Quality Assurance/ Quality Control

Routine chemical analyses of water samples were performed under contract primarily by Severn Trent Laboratories, Inc., St. Louis, Missouri, for environmental surveillance and groundwater monitoring. Some routine analyses of hazardous and non-hazardous chemicals for the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) groundwater program also were performed under contract by Lionville Laboratory, Inc., Lionville, Pennsylvania. Each laboratory participated in the EPA Water Pollution and Water Supply Performance Evaluation Studies. Each laboratory maintained an internal quality control program that met the requirements in *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, Third Edition* (EPA 1986); each program was audited and reviewed internally and by Pacific Northwest National Laboratory. Pacific Northwest National Laboratory submitted additional quality control double-blind spiked samples for analysis.

**Table 9.0.1. Summary of Field Replicate Results for the Surface Environmental Surveillance Project at Hanford, 2002**

| Medium | Radionuclides | Number of Results Reported | Number Within Control Limits[a] |
|---|---|---|---|
| Water | Gross alpha | 1 | 0 |
| | Gross beta | 1 | 1 |
| | $^{3}H$ | 4 | 4 |
| | $^{7}Be$, $^{40}K$, $^{60}Co$, $^{106}Ru$, $^{125}Sb$, $^{134}Cs$, $^{137}Cs$, $^{154}Eu$, $^{155}Eu$ | 9 | 0 |
| | $^{90}Sr$ | 3 | 3 |
| | $^{234}U$, $^{235}U$, $^{238}U$ | 9 | 7 |
| | $^{238}Pu$, $^{239/240}Pu$ | 0 | 0 |
| Biota | $^{7}Be$, $^{40}K$, $^{60}Co$, $^{106}Ru$, $^{125}Sb$, $^{134}Cs$, $^{137}Cs$, $^{154}Eu$, $^{155}Eu$ | 36 | 7 |
| | $^{90}Sr$ | 4 | 1 |

(a) The sample and duplicate results are acceptable if they have a relative percent difference of less than ±30% for the sample and duplicate and the result is above the detection limit or minimum detectable activity.

**Double-blind spiked sample** – A sample of known activity/concentration prepared to look like a typical sample submitted to the analytical service laboratory.

Routine radiochemical analyses of samples for the Surface Environmental Surveillance and Hanford Groundwater Monitoring Projects were performed primarily by Severn Trent Laboratories, Inc., Richland, Washington. Severn Trent Laboratories, Inc., Richland, participated in DOE's Quality Assessment Program at the Environmental Measurements Laboratory in New York, and the InterLab RadChem Proficiency Testing Program conducted by Environmental Resource Associates. Environmental Resource Associates prepared and distributed proficiency standard samples according to EPA requirements. A quality control blind spiked sample program also was conducted for each project by Pacific Northwest National Laboratory. The laboratory maintains an internal quality control program, which was audited and reviewed internally and by Pacific Northwest National Laboratory. Additional information on these quality control efforts is provided in the following sections.

## 9.0.1.4 DOE and EPA Comparison Studies

Standard water samples were distributed blind (activities and concentrations unknown to the analytical laboratory) to participating laboratories as part of the EPA performance evaluation program. These blind samples contained specific organic and inorganic analytes that had concentrations unknown to the analyzing laboratories. After analysis, the results were submitted to Environmental Resource Associates, the EPA performance evaluation program sponsor, for comparison with known values and results from other participating laboratories. Summaries of the results for 2002 groundwater samples are provided in PNNL-14187, Appendix B, for the primary laboratory, Severn Trent Laboratories, Inc., St. Louis.

The DOE Quality Assessment Program and Environmental Resource Associates' Proficiency Testing Program provided standard samples of environmental media (e.g., water, air filters, soil, vegetation) that contained specific amounts of one or more radionuclides that were unknown by the participating laboratory. After analysis, the results were forwarded to the DOE Quality Assessment Program or Environmental Resource Associates for comparison with known values and results from other laboratories. Both the DOE Quality Assessment Program and Environmental Resource Associates had established criteria for evaluating the accuracy of results (NERL-Ci-0045; EML-617; EML-618). Summaries of the 2002 results are provided in Tables 9.0.2 and 9.0.3. Ninety-three percent of the DOE quality assessment sample results fell within the acceptable control limits as defined by the DOE Quality Assessment Program. Ninety-eight percent of the Environmental Resource Associates samples fell within the acceptable control limit range as defined by the *National Standards for Water Proficiency Testing Studies Criteria* document (NERL-Ci-0045).

## 9.0.1.5 Pacific Northwest National Laboratory Evaluations

In addition to DOE and EPA interlaboratory quality control programs, Pacific Northwest National Laboratory maintained a quality control program to evaluate analytical contractor precision and accuracy and to conduct special intercomparisons. This program included the use of both radiological and non-radiological blind spiked samples. Blind spiked quality control samples and blanks were prepared and submitted to check the accuracy and precision of analyses at Severn Trent Laboratories, Inc., Richland. In 2002, 224 blind spiked samples were submitted for the Hanford Groundwater Monitoring Project (PNNL-14187, Appendix B) and 10 samples were submitted for the Surface Environmental Surveillance Project. The samples included air filters, soil, surface water, and vegetation (Table 9.0.4). The results of all water sample non-radiochemistry blind spiked determinations are discussed in Appendix B of PNNL-14187 and indicated an acceptable performance by the laboratory.

**Blind spiked sample** – A sample of known activity/concentration submitted to the analytical laboratory but not necessarily in the same physical geometry as the typical samples submitted.

**Table 9.0.2. Summary of Laboratory Performance on DOE Quality Assessment Program Samples for the Surface Environmental Surveillance Project at Hanford, 2002**

| Medium | Radionuclides | Number of Results Reported for Each Analyte | Number Within Acceptable Control Limits[a] |
|---|---|---|---|
| **Severn Trent Laboratories, Richland, Washington** | | | |
| Air filter particulate | Gross alpha, gross beta, $^{54}$Mn, $^{60}$Co, $^{90}$Sr, $^{137}$Cs, $^{241}$Am, total uranium | 2 | 2 |
| | $^{238}$Pu, $^{239}$Pu | 2 | 1 |
| | $^{234}$U, $^{238}$U | 1 | 1 |
| Soil | $^{40}$K, $^{90}$Sr, $^{137}$Cs, $^{212}$Pb, $^{214}$Bi, $^{214}$Pb, $^{228}$Ac, $^{239}$Pu, $^{241}$Am, total uranium | 2 | 2 |
| | $^{234}$Th | 2 | 1 |
| | $^{234}$U, $^{238}$U | 1 | 1 |
| Vegetation | $^{40}$K, $^{60}$Co, $^{137}$Cs, $^{239}$Pu, $^{241}$Am, $^{244}$Cm | 2 | 2 |
| | $^{90}$Sr | 1 | 1 |
| Water | $^{3}$H, $^{60}$Co, $^{90}$Sr, $^{137}$Cs, $^{238}$Pu, $^{239}$Pu, $^{241}$Am, total uranium | 2 | 2 |
| | Gross alpha, gross beta, $^{134}$Cs | 2 | 1 |
| | $^{234}$U, $^{238}$U | 1 | 1 |

(a) Control limits are from EML-617 and EML-618.

**Table 9.0.3. Summary of Laboratory Performance on Hanford Site Surface Environmental Surveillance Project Samples by the Environmental Resource Associates Proficiency Testing Program, 2002**

| Medium | Radionuclides | Number of Results Reported for Each Analyte | Number Within Control Limits for Each Analyte[a] |
|---|---|---|---|
| **Severn Trent Laboratories, Richland, Washington** | | | |
| Water | Gross alpha, gross beta, $^{226}$Ra, $^{228}$Ra, total uranium | 4 | 4 |
| | $^{60}$Co, $^{89}$Sr, $^{90}$Sr, $^{137}$Cs | 3 | 3 |
| | $^{134}$Cs | 3 | 2 |
| | $^{3}$H, $^{131}$I | 2 | 2 |
| | $^{65}$Zn, $^{131}$I | 1 | 1 |

(a) Control limits are from NERL-Ci-0045.

**Table 9.0.4. Summary of Hanford Site Surface Environmental Surveillance Project Blind Spiked Determinations, 2002**

| Medium | Radionuclides | Number of Results Reported | Number Within Control Limits[a] |
|---|---|---|---|
| **Severn Trent Laboratories, Richland, Washington** | | | |
| Air Filters | $^{60}$Co, $^{134}$Cs, $^{137}$Cs, $^{238}$Pu | 2 | 2 |
| | $^{90}$Sr, $^{125}$Sb | 2 | 1 |
| | $^{239/240}$Pu | 1 | 1 |
| Soil | $^{40}$K, $^{90}$Sr, $^{137}$Cs, $^{239/240}$Pu | 2 | 2 |
| | $^{238}$Pu | 1 | 1 |
| | $^{60}$Co | 1 | 0 |
| Vegetation | $^{40}$K, $^{60}$Co, $^{137}$Cs | 2 | 2 |
| | $^{90}$Sr | 2 | 1 |
| | $^{238}$Pu | 1 | 1 |
| Surface Water | $^{3}$H, $^{60}$Co, $^{137}$Cs, $^{238}$Pu, $^{239/240}$Pu | 2 | 2 |
| | $^{134}$Cs | 1 | 1 |

(a) Control limit of ±30%.

For all media, 91% of Severn Trent Laboratories, Inc., Richland, radiochemistry blind spiked determinations were within the control limits (±30% of the known value), which indicated acceptable results. Two gamma determinations were not acceptable – an analysis for cobalt-60 in soil and an analysis for antimony-125 in an air filter. Also, a determination of strontium-90 in an air filter was lost in the laboratory.

## 9.0.1.6 Quality Assurance Task Force Results

Pacific Northwest National Laboratory also participated in the Quality Assurance Task Force, a program coordinated by the Washington State Department of Health. Public and private organizations from Idaho, Oregon, and Washington participated in analyzing intercomparison samples in 1999, 2000, and 2001. For the 2002 intercomparison sample exchange, soil samples from the Hanford Site were collected and dried. Results for uranium-234, uranium-235, uranium-238, and total uranium were determined for three aliquots. The Pacific Northwest National Laboratory determinations and the average and 2 standard deviations of each analyte are presented in Table 9.0.5. The results reported to the task force by other laboratories had not been released at the time of this report for comparison.

## 9.0.1.7 Laboratory Internal Quality Assurance Programs

The analytical laboratories were required to maintain an internal quality assurance and control program. Periodically, the laboratories were audited for compliance to the quality assurance and control programs. At Severn Trent Laboratories, Inc., St. Louis, the quality control program met the quality assurance and control criteria in *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, Third Edition* (EPA 1986). The laboratories also were required to maintain a system to review and analyze the results of the quality control samples to detect problems that may have arisen from contamination, inadequate calibrations, calculation errors, or improper procedure performance. Method detection levels were determined at least annually for each analytical method.

The internal quality control program at Severn Trent Laboratories, Inc., Richland, involved routine calibrations

**Table 9.0.5. Pacific Northwest National Laboratory Determinations of Quality Assurance Task Force Intercomparison Soil Sample at Hanford, 2002**

| Radionuclide | Determination Number | Intercomparison Sample Concentrations, pCi/g[a] | Average ±2SD,[b] pCi/g |
|---|---|---|---|
| Uranium-234 | 1 | 352 ± 63 | |
| | 2 | 300 ± 48 | |
| | 3 | 328 ± 59 | 326 ± 52 |
| Uranium-235 | 1 | 14.7 ± 2.8 | |
| | 2 | 11.4 ± 2.6 | |
| | 3 | 14.1 ± 2.7 | 13.4 ± 1.8 |
| Uranium-238 | 1 | 337 ± 60 | |
| | 2 | 267 ± 43 | |
| | 3 | 314 ± 56 | 299 ± 65 |
| Total uranium | 1 | 446 ± 110 | |
| | 2 | 451 ± 110 | |
| | 3 | 363 ± 86 | 306 ± 72 |

(a) To convert pCi/g to Bq/g, multiply by 0.037.
(b) SD = Standard deviation.

of counting instruments, yield determinations of radiochemical procedures, frequent radiation check sources and background counts, replicate and spiked sample analyses, matrix and reagent blanks, and maintenance of control charts to indicate analytical deficiencies. Available calibration standards traceable to the National Institute of Standards and Technology were used for radiochemical calibrations. Calculation of minimum detectable concentrations involved the use of factors such as the average counting efficiencies and background for detection instruments, length of time for background and sample counts, sample volumes, radiochemical yields, and a predesignated uncertainty multiplier (EPA 520/1-80-012).

Periodically, inspections of services were performed that documented conformance with contractual requirements of the analytical facility and provided the framework to identify and resolve potential performance problems. Responses to assessment and inspection findings were documented by written communication, and corrective actions were verified by follow-up audits and inspections. In 2002, assessments of Severn Trent Laboratories, Inc., Richland, and Severn Trent Laboratories, Inc., St. Louis, were conducted January 22 to 25, 2002 and April 23 to 26, 2002, respectively. Representatives from Bechtel Hanford, Inc. and Pacific Northwest National Laboratory conducted both audits. The purpose of the assessments was to evaluate the continued support of analytical services to Hanford Site contractors as specified in the statement of work between Fluor Hanford, Inc. and Severn Trent Laboratories, Inc. Additional information may be found in PNNL-14187, Appendix B.

Internal laboratory quality control program data were reported with the analytical results. Scientists at Pacific Northwest National Laboratory summarized the results quarterly. The Surface Environmental Surveillance Project and the Hanford Groundwater Monitoring Project indicated that each laboratory met the contract specified requirements for each quarter of calendar year 2002 (for the Surface Environmental Surveillance Project) and fiscal year 2002 (for the Hanford Groundwater Monitoring Project).

## 9.0.1.8 Media Audits and Comparisons

Additional audits and comparisons were conducted on several specific types of samples. The Washington State Department of Health routinely co-sampled various environmental media and measured external radiation levels at multiple locations during 2002. Media that were co-sampled and analyzed for radionuclides included groundwater, irrigation water, water from 20 locations along and across the Columbia River, water from 7 riverbank springs, water from 2 onsite drinking water locations, sediment from 9 Columbia River sites, surface soil from 2 locations on the Hanford Site, and mineral and organic soil from White Pass. Also co-sampled and analyzed for radionuclides were upwind and downwind samples of bass, carp, cherries, leafy vegetables, mule deer, potato tubers, quail, and red and white wines. The Washington State Department of Health and Pacific Northwest National Laboratory co-sampled data may be found in PNNL-14295, APP. 1.

The U.S. Food and Drug Administration also received co-samples from upwind and downwind sampling locations and analyzed cherries, leafy vegetables, and potatoes for radionuclides (Table 9.0.6). One result determined by the U.S. Food and Drug Administration was a positive result. The one positive result was for strontium-90 in cherries and did not agree with its duplicate or the result determined by Pacific Northwest National Laboratory, making this a questionable value.

Quality control for environmental thermoluminescent dosimeters included the audit exposure of three environmental thermoluminescent dosimeters per quarter to known values of radiation (between 17 and 30 mR). For the 12 measurements, the lowest ratio of determined/known exposure was 0.94; the highest determined/known exposure ratio was 1.10, with an average of 1.02 ± 0.05 (Table 9.0.7).

## 9.0.2 Effluent Monitoring and Near-Facility Environmental Monitoring

The Effluent Monitoring and Near-Facility Environmental Monitoring Programs were subject to the quality assurance requirements specified in the *Hanford Analytical Services Quality Assurance Requirements Document* (DOE/RL-96-68). This quality assurance program complied with DOE Order 414.1A, using standards from the American Society of Mechanical Engineers (ASME NQA-1-1997) as its basis. The program also adhered to the guidelines and objectives in EPA/005/80 and EPA QA/R-5.

The monitoring programs each have a quality assurance project plan describing applicable quality assurance elements. These plans were approved by contractor quality assurance groups, who conducted surveillances and audits to verify compliance with the project plans. Work such as sample analyses that were performed through contracts had to meet the requirements of these quality assurance project plans. Suppliers were audited before the contract selection was made for equipment and services that may have significantly affected the quality of a project.

### 9.0.2.1 Sample Collection Quality Assurance

Samples for the Effluent Monitoring and Near-Facility Environmental Monitoring Programs were collected by staff trained for the task in accordance with approved procedures. Established sampling locations were accurately identified and documented to assure continuity of data for those sites and are described in DOE/RL-91-50.

### 9.0.2.2 Analytical Results Quality Assurance

Samples for the Effluent Monitoring and Near-Facility Environmental Monitoring Programs were analyzed by up to three different analytical laboratories. The use of these laboratories is dependent on the Hanford contractor collecting the samples and contract(s) established between the contractor and the analytical laboratory(s). Table 9.0.8 provides a summary of the analytical laboratories used by Hanford Site contractors for processing effluent monitoring and near-facility monitoring samples.

The quality of the analytical data was assured by several means. Counting room instruments, for instance, were kept within calibration limits through daily checks, the results of which were stored in computer databases. Radiochemical standards used in analyses were regularly measured and the results were reported and tracked. Formal, written laboratory procedures were used when analyzing samples. Analytical procedural control was assured through administrative procedures. Chemical technologists at the laboratory were qualified to perform analyses through formal classroom and on-the-job training.

The participation of the Hanford Site analytical laboratories in EPA and DOE laboratory performance evaluation programs also served to assure the quality of the data produced. The performance of the Waste Sampling and Characterization Facility was evaluated in four different laboratory performance studies for 2002. In the EPA Water Pollution Studies #84 and #90 for inorganic and organic analyses, 314 different analytes and compounds were submitted to the Waste Sampling and Characterization Facility for analysis. Of the 314 analyses performed, 277 results were acceptable while 37 were unacceptable for a total acceptable rate of 88%. The acceptance criteria

## Table 9.0.6. Comparison of Co-Sampling Results for Samples Collected Near the Hanford Site, 2002[a]

| Medium | Sampling Area | Organization[b] | Strontium-90, pCi/g[c,d] | Cesium-137, pCi/g[c,d] | Ruthenium-106, pCi/g[c,d] | Iodine-131 pCi/g[c,d] | Tritium pCi/g[c,d] |
|---|---|---|---|---|---|---|---|
| Leafy vegetables (stem-leaf) | Sunnyside | FDA | <0.002 | <0.045 | <0.10 | <0.045 | <200 |
| | | FDA | <0.002 | <0.045 | <0.10 | <0.045 | <200 |
| | | PNNL | -0.00019 ± 0.0023 | -0.0055 ± 0.011 | 0.059 ± 0.092 | NA[e] | NA |
| | Riverview | FDA | <0.002 | <0.045 | <0.10 | <0.045 | <200 |
| | | FDA | <0.002 | <0.045 | <0.10 | <0.045 | <200 |
| | | PNNL | 0.00139 ± 0.0022 | -0.00389 ± 0.012 | -0.0201 ± 0.11 | NA | NA |
| Cherries/Fruit | Sagemoor | FDA | <0.002 | <0.045 | <0.10 | <0.045 | <200 |
| | | FDA | 2.5 ± 0.7 | <0.045 | <0.10 | <0.045 | <200 |
| | | PNNL | -0.00102 ± 0.0018 | 0.00156 ± 0.0036 | 0.0063 ± 0.033 | NA | NA |
| Potato tuber | Horn Rapids | FDA | <0.002 | <0.045 | <0.10 | <0.045 | <200 |
| | | FDA | <0.002 | <0.045 | <0.10 | <0.045 | <200 |
| | | PNNL | 0.00915 ± 0.0083 | 0.00424 ± 0.0035 | -0.02 ± 0.035 | NA | NA |
| | Sunnyside | FDA | <0.002 | <0.045 | <0.10 | <0.045 | <200 |
| | | FDA | <0.002 | <0.045 | <0.10 | <0.045 | <200 |
| | | PNNL | 0.0079 ± 0.0074 | 0.00022 ± 0.0051 | 0.0151 ± 0.043 | NA | NA |

(a) Sample results are wet weight.
(b) FDA = U.S. Food and Drug Administration; PNNL = Pacific Northwest National Laboratory.
(c) To convert pCi/g to Bq/g, multiply by 0.037.
(d) Errors reported are 2 standard deviations. Less than (<) values are minimum detectable activities at 3 standard deviations.
(e) NA = Not analyzed; not specifically requested by contract unless present.

## Table 9.0.7. Comparison of Pacific Northwest National Laboratory Thermoluminescent Dosimeter Results with Known Exposure, 2002

| Quarter | Exposure Date | Known Exposure[a,b] milliroentgen (mR) | Determined Exposure[c] milliroentgen (mR) | Ratio of Determined/ Known Exposure |
|---|---|---|---|---|
| 1st | February 22, 2002 | 26 ± 0.97 | 27.83 ± 0.83 | 1.07 |
| | | 22 ± 0.82 | 23.27 ± 0.12 | 1.06 |
| | | 18 ± 0.67 | 19.88 ± 0.26 | 1.10 |
| 2nd | May 17, 2002 | 23 ± 0.86 | 24.47 ± 0.63 | 1.06 |
| | | 29 ± 1.08 | 28.78 ± 0.62 | 0.99 |
| | | 17 ± 0.63 | 17.67 ± 0.84 | 1.04 |
| 3rd | August 27, 2002 | 21 ± 0.78 | 20.62 ± 0.25 | 0.98 |
| | | 28 ± 1.04 | 29.69 ± 0.55 | 0.95 |
| | | 19 ± 0.71 | 20.66 ± 0.085 | 0.94 |
| 4th | November 15, 2002 | 27 ± 1 | 27.63 ± 0.69 | 1.02 |
| | | 24 ± 0.89 | 25.00 ± 0.51 | 1.04 |
| | | 20 ± 0.74 | 19.99 ± 0.54 | 1.00 |

(a) ±2 total propagated analytical uncertainty.
(b) Assumed 2 standard deviation error was 3.72%.
(c) ±2 times the standard deviation.

**Table 9.0.8. Hanford Site Laboratories Used by Site Contractors and Types of Effluent Monitoring and Near-Facility Monitoring Samples Analyzed, 2002**

| Analytical Laboratory | Effluent Monitoring Samples | | | | | Near-Facility Environmental Monitoring Samples | | |
|---|---|---|---|---|---|---|---|---|
| | Fluor Hanford, Inc. | | Pacific Northwest National Laboratory | Bechtel Hanford, Inc. | | Fluor Hanford, Inc. | | |
| | Air | Water | Air | Air | Water | Air | Water | Other |
| Waste Sampling and Characterization Facility[a] | X | X | | X | X | X | X | X |
| 222-S Analytical Laboratory[a] | | | | | | | | X |
| Severn Trent Laboratories, Inc., Richland | X | X | X | X | X | | | |
| Analytical Chemistry Laboratory[b] | X | X | X | | | | | |

(a) Operated by Fluor Hanford, Inc.
(b) Operated by Pacific Northwest National Laboratory.

were defined by EPA. In the DOE Mixed Analyte Performance Evaluation Program studies (MAPEP-01-W9 and MAPEP-02-S9), 79 different radionuclides and analytes were submitted to the Waste Sampling and Characterization Facility for analysis. Of the 79 different analyses performed, 75 results were acceptable while 4 were unacceptable for a total acceptable rate of 95% as defined by the Mixed Analyte Performance Evaluation Program studies. In the National Institute of Standards and Technology Radiochemistry Program study, 8 different radionuclides were submitted to the Waste Sampling and Characterization Facility for 40 different analyses. All radionuclide results were acceptable except for a strontium-90 result from an air filter. The acceptance criteria were defined by the National Institute of Standards. In the DOE Quality Assessment Program, 74 different radionuclides were submitted to the Waste Sampling and Characterization Facility for analysis. Of the 74 analyses performed, 70 results were acceptable while 4 were unacceptable for a total acceptable rate of 95%. The acceptance criteria were defined by the DOE Quality Assessment Program. Performance results for the DOE Quality Assessment Program and others are presented in Tables 9.0.9 through 9.0.11.

**Table 9.0.9. The Hanford Site's Waste Sampling and Characterization Facility[a] Performance on DOE Quality Assessment Program Samples, 2002**

| Medium | Radionuclide | Number of Results Reported | Number Within Control Limits |
|---|---|---|---|
| Air filters | $^{54}$Mn, $^{60}$Co, $^{90}$Sr, $^{134}$Cs, $^{234}$U, $^{238}$Pu, $^{238}$U, $^{239}$Pu, $^{241}$Am, gross alpha, gross beta | 22 | 21 ($^{90}$Sr failed once) |
| Soil | $^{40}$K, $^{90}$Sr, $^{137}$Cs, $^{234}$U, $^{238}$U, $^{239}$Pu, $^{241}$Am | 14 | 12 ($^{234}$U and $^{238}$U failed once) |
| Vegetation | $^{40}$K, $^{60}$Co, $^{90}$Sr, $^{137}$Cs, $^{239}$Pu, $^{241}$Am, $^{244}$Cm | 14 | 14 |
| Water | $^{3}$H, $^{60}$Co, $^{90}$Sr, $^{134}$Cs, $^{137}$Cs, $^{234}$U, $^{238}$Pu, $^{238}$U, $^{239}$Pu, $^{241}$Am, gross alpha, gross beta | 24 | 23 (Gross alpha failed once) |

(a) Onsite laboratory operated by Fluor Hanford, Inc.

**Table 9.0.10. The Hanford Site's 222-S Analytical Laboratory[a] Performance on DOE Quality Assessment Program Samples, 2002**

| Medium | Radionuclide | Number of Results Reported | Number Number Within Acceptable Limits |
|---|---|---|---|
| Air filters | $^{54}$Mn, $^{60}$Co, $^{90}$Sr, $^{134}$Cs, $^{238}$Pu, $^{239}$Pu, $^{241}$Am, gross alpha, gross beta | 18 | 17 |
| Soil | $^{90}$Sr, $^{137}$Cs, $^{212}$Pb, $^{214}$Bi, $^{214}$Pb, $^{228}$Ac, $^{239}$Pu, total uranium | 16 | 14 |
| Vegetation | $^{90}$Sr, $^{137}$Cs, $^{239}$Pu, $^{241}$Am, $^{244}$Cm | 10 | 7 |
| Water | $^{3}$H, $^{60}$Co, $^{90}$Sr, $^{137}$Cs, $^{238}$Pu, $^{239}$Pu, $^{241}$Am, gross alpha, gross beta, total uranium | 21 | 15 |

(a) Onsite "high-level" radiological laboratory operated by Fluor Hanford, Inc. (Note: These samples are "low-level" environmental activity samples.)

**Table 9.0.11. The Hanford Site's 222-S Analytical Laboratory[a] Performance on EPA Laboratory Water Pollution Inorganic and Organic Studies, 2002**

| Laboratory | Water Pollution Study (WP-87) June 2002 % Acceptable | Water Pollution Study (WP-93) December 2002 % Acceptable |
|---|---|---|
| 222-S Analytical Laboratory | 96[b] | 98[c] |

(a) Onsite "high-level" radiological laboratory operated by Fluor Hanford, Inc.
(b) Ninety of 94 analytes defined by EPA as acceptable.
(c) One hundred and five of 107 analytes defined by EPA as acceptable.

## 9.0.3 References


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